

CLAIMS

1. A process for fortifying a fruit juice beverage with calcium, comprising:

    providing a supply of fruit juice as a flow of juice;  
    supplying a calcium source into said flow of juice, said supplying being from an upstream in-line mixer along the flow of juice, whereby calcium is incorporated into the flow of juice to provide a calcium-augmented flow of juice;  
    supplying a food-grade acid source from a downstream in-line mixer along the flow of juice, the downstream mixer being spaced from the upstream in-line mixer, whereby acid is incorporated into the calcium-augmented flow of juice to form a calcium-fortified flow of juice having a component of calcium and acid; and  
    collecting the calcium-fortified flow of juice as a calcium-fortified fruit juice beverage.

2. The process in accordance with claim 1, wherein said calcium source is selected from the group consisting of calcium hydroxide, calcium carbonate, calcium citrate, calcium phosphate, calcium chloride, calcium malate and combinations thereof, and wherein said acid source is selected from the group consisting of malic acid, phosphoric acid, adipic acid, fumaric acid, benzoic acid, gluconic acid, lactic acid, goinic acid, and combinations thereof.

3. The process in accordance with claim 1, wherein said calcium source is calcium hydroxide.

4. The process in accordance with claim 1, wherein said acid source is malic acid.

5. The process in accordance with claim 3, wherein said acid source is malic acid.
6. The process in accordance with claim 1, wherein said acid source is phosphoric acid.
7. The process in accordance with claim 1, wherein said acid source is a combination of malic acid and phosphoric acid.
8. The process in accordance with claim 1, wherein the component of calcium and acid comprises calcium malate.
9. The process in accordance with claim 1, wherein said supplying of a calcium source and said supplying of an acid source occur at substantially the same time into the flow of juice but at different locations along the flow of juice.
10. The process in accordance with claim 1, wherein said supplying of the acid source is initiated along the flow of juice within five minutes after initiation of said supplying of the calcium source along the flow of juice.
11. The process in accordance with claim 1, wherein said supplying of the acid source includes refraining from supplying citric acid into the flow of juice.
12. The process in accordance with claim 2, wherein said supplying of the acid source includes refraining from adding citric acid into the flow of juice.
13. The process in accordance with claim 5, wherein said supplying of the acid source includes refraining from supplying citric acid into the flow of juice.

14. The process in accordance with claim 2, wherein said supplying of the calcium source into the flow of juice results in the calcium-fortified juice beverage having between about 0.02 and about 0.25 weight percent of calcium, based on the total weight of calcium-fortified juice beverage.

15. The process in accordance with claim 2, wherein said supplying of the acid source into the flow of juice results in the calcium-fortified juice beverage having between about 0.06 and about 0.8 weight percent of acid, based on the total weight of calcium-fortified juice beverage.

16. The process in accordance with claim 1, wherein said flow of juice is at a flow rate of between about 150 and about 400 gallons per minute of juice.

17. The process in accordance with claim 1, wherein said supplying provides the calcium source and said acid source at a weight ratio of between about 1:2.7 calcium to acid and about 1:3.3 calcium to acid.

18. The process in accordance with claim 5, wherein said supplying provides the calcium source and said acid source at a weight ratio of between about 1:2.7 calcium to acid and about 1:3.3 calcium to acid.

19. The process in accordance with claim 1, wherein said supplying of the calcium source and said supplying of the acid source each are accomplished under high-shear mixing conditions.

20. A process for fortifying a not-from-concentrate (NFC) juice with calcium, comprising:

providing a supply of not-from-concentrate juice as a flow of NFC juice;

supplying a calcium source into said flow of NFC juice, said supplying being from an upstream in-line mixer along the flow of NFC juice, whereby calcium is incorporated into the flow of NFC juice in order to provide a calcium-augmented flow of NFC juice;

supplying a food-grade acid source from a downstream in-line mixer along the flow of juice, the downstream mixer being spaced from the upstream in-line mixer, whereby food-grade acid is incorporated into the calcium-augmented flow of NFC juice to form a calcium-fortified flow of NFC juice having a combination of calcium and malate; and

collecting the calcium-fortified flow of juice as a calcium-fortified NFC juice.

21. The process in accordance with claim 20, wherein said supplying of a calcium source and said supplying of an acid source occur at substantially the same time into the flow of juice but at different locations along the flow of juice.

22. The process in accordance with claim 20, wherein said supplying of an acid source is initiated along the flow of juice within five minutes after initiation of said supplying of the calcium source along the flow of juice.

23. The process in accordance with claim 20, wherein said supplying of the acid source includes refraining from adding citric acid into the flow of juice.

24. The process in accordance with claim 20, wherein said supplying of the calcium source into the flow of juice results

in the calcium-fortified juice beverage having between about 0.02 and about 0.25 weight percent of calcium, based on the total weight of calcium-fortified juice beverage; wherein said supplying of the acid source into the flow of juice results in the calcium-fortified juice beverage having between about 0.06 and about 0.8 weight percent of acid, based on the total weight of calcium-fortified juice beverage; and wherein said flow of NFC citrus juice is at a flow rate of between about 150 and about 400 gallons per minute of juice.

25. A process for fortifying a not-from-concentrate (NFC) citrus juice with calcium, comprising:

providing a supply of not-from-concentrate citrus juice as a flow of NFC citrus juice;

supplying a calcium source into said flow of NFC citrus juice, said supplying being from an upstream in-line mixer along the flow of NFC citrus juice, whereby calcium is incorporated into the flow of NFC citrus juice under high-shear mixing conditions in order to provide a calcium-augmented flow of citrus juice;

supplying a source of organic acid selected from a malic acid source, a phosphoric acid source, and combinations of said sources from a downstream in-line mixer along the flow of citrus juice, the downstream mixer being spaced from the upstream in-line mixer, whereby the source of organic acid is incorporated into the calcium-augmented flow of citrus juice under high-shear mixing to form a calcium-fortified flow of citrus juice having a combination of calcium and malate, calcium and phosphate, calcium malate phosphate, or both calcium malate and calcium phosphate;

collecting the calcium-fortified flow of citrus juice as a calcium-fortified NFC citrus juice; and

wherein said supplying of a calcium source and said supplying of an acid source occur at substantially the same

time into the flow of juice but at different locations along the flow of juice.

26. The process in accordance with claim 25, wherein said supplying of the acid source is initiated along the flow of juice within five minutes after initiation of said supplying of the calcium source along the flow of juice.

27. The process in accordance with claim 25, wherein said supplying of the acid source includes refraining from supplying citric acid into the flow of juice.

28. The process in accordance with claim 25, wherein said supplying of the calcium source of juice results in the calcium-fortified juice beverage having between about 0.02 and about 0.25 weight percent of calcium, based on the total weight fortified juice beverage; and wherein said supplying of the acid source the flow of juice results in the calcium-fortified juice beverage having between about 0.06 and about 0.8 weight percent of acid, based on the total weight of calcium-fortified juice beverage.

29. A fruit juice beverage prepared according to the process of claim 1, wherein said calcium-fortified fruit juice beverage has a Daily Value of calcium per 240 milliliter serving of at least about 60 percent DV.

30. A fruit juice beverage prepared according to the process of claim 1, wherein said calcium-fortified fruit juice beverage has a calcium content of at least about 0.1 weight percent, based upon the total weight of the fruit juice beverage.

31. A fruit juice beverage prepared according to the process of claim 1, wherein at least about 90 weight percent of calcium of the calcium-fortified fruit juice beverage remains solubilized within the beverage for at least five weeks.

32. The beverage in accordance with claim 31, wherein said calcium-fortified fruit juice beverage has a Daily Value of calcium per 240 milliliter serving of at least about 60 percent DV.

33. The beverage in accordance with claim 31, wherein said calcium-fortified fruit juice beverage has a calcium content of at least about 0.1 weight percent, based upon the total weight of the fruit juice beverage.

34. The beverage in accordance with claim 29, wherein said calcium-fortified fruit juice beverage has a Daily Value of calcium per 240 milliliter serving of at least about 100 percent DV.

35. The beverage in accordance with claim 30, wherein said calcium-fortified fruit juice beverage has a calcium content of at least about 0.15 weight percent, based upon the total weight of the fruit juice beverage.

36. The beverage in accordance with claim 34, wherein at least about 90 weight percent of calcium of the calcium-fortified fruit juice beverage remains solubilized within the beverage for at least five weeks.

37. The beverage in accordance with claim 35, wherein said calcium-fortified fruit juice beverage has a Daily Value of calcium per 240 milliliter serving of at least about 60 percent DV.

38. A not-from-concentrate juice prepared according to the process of claim 20, wherein said calcium-fortified NFC juice has a Daily Value of calcium per 240 milliliter serving of at least about 60 percent DV.

39. A not-from-concentrate juice prepared according to the process of claim 1, wherein said calcium-fortified NFC juice has a calcium content of at least about 0.1 weight percent, based upon the total weight of the NFC juice.

40. A not-from-concentrate juice prepared according to the process of claim 20, wherein at least about 90 weight percent of calcium of the calcium-fortified NFC juice remains solubilized within the beverage for at least five weeks.

41. The juice in accordance with claim 40, wherein said calcium-fortified NFC juice has a Daily Value of calcium per 240 milliliter serving of at least about 60 percent DV.

42. The juice in accordance with claim 40, wherein said calcium-fortified NFC juice has a calcium content of at least about 0.1 weight percent, based upon the total weight of the NFC juice.

43. The juice in accordance with claim 38, wherein said calcium-fortified NFC juice has a Daily Value of calcium per 240 milliliter serving of at least about 100 percent DV.

44. The juice in accordance with claim 38, wherein said calcium-fortified NFC juice has a calcium content of at least about 0.12 weight percent, based upon the total weight of the NFC juice.

45. The juice in accordance with claim 38, wherein at least 90 weight percent of calcium of the calcium-fortified NFC juice remains solubilized within the juice for at least five weeks.

46. The juice in accordance with claim 45, wherein said calcium-fortified NFC juice has a Daily Value of calcium per 240 milliliter serving of at least about 60 percent DV.

47. The juice in accordance with claim 38, wherein said calcium-fortified NFC juice is a citrus juice.